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Smart Aquaculture: Automated Fish Feeding with Blynk Alerts

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ABSTRACT

Rapid developments in aquaculture have driven the need for efficient and sustainable feeding systems. This study presents the design and implementation of an automatic fish feeder using the Wokwi platform, integrated with the Blynk application. The system aims to deliver feed at optimal intervals and quantities, improving fish growth while minimizing waste. The research utilizes ESP32 as the main controller and servo motors to operate the feeder mechanism. Feeding schedules can be remotely controlled via the Blynk mobile app, allowing for flexible and precise feed management. Testing results indicate that the system consistently provides accurate feed portions at designated intervals, demonstrating reliability and ease of use. This automated feeder offers a cost-effective and environmentally friendly solution for aquaculture, reducing the labor and inefficiencies associated with manual feeding. Consequently, this innovation represents a significant advancement in aquaculture technology, promoting sustainable practices and enhancing overall operational efficiency.

KEYWORD Aquaculture, IoT, Blynk, Automated Feeding, Remote Monitoring.

1. INTRODUCTION

Aquaculture is one of the fastest growing food production sectors in the world, playing an important role in food security and global economic development. As a growing industry, aquaculture is faced with various challenges,[1] one of which is optimal feeding management to support fish growth while minimizing feed waste. The manual feeding system that is still widely used today has several limitations, such as dependence on labor,[2], [3] requires a long time, and is often inefficient in terms of the frequency and quantity of feed given.[4], [5], [6] Along with the advancement of Internet of Things (IoT) technology, [7], [8], [9] various smart aquaculture solutions have been introduced to automate and optimize the feeding process. Several previous studies have discussed the potential of IoT technology in improving aquaculture management efficiency. For example, research by Wang et al. (2020) developed an IoT-based automated feeding system capable of reducing manual involvement and improving feeding precision. In addition, Zhang et al. [10] showed that remote supervision and control of smart aquaculture systems can increase productivity by reducing human error. Technological advancements have played a significant role in the recent progress of aquaculture [11]. One notable development is the automatic fish feeder, which is designed to dispense food to fish in a more efficient and systematic manner. Although there are many automatic feeders available on the market, the need to connect these devices with modern IoT platforms for remote control and monitoring remains unmet. This study addresses that gap by creating an automatic feeder using the Wokwi platform, which is linked with the Blynk app. Wokwi serves as an online simulator for Arduino and other hardware, while Blynk is a platform that allows for the remote control of devices such as Arduino and Raspberry Pi via the Internet, accessible on both iOS and Android. By integrating these two platforms, the project aims to enhance the efficiency and management of aquaculture [11], [12].

However, research that focuses more on the integration of IoT platforms such as Blynk in the management of feeding is still limited. Therefore, this research aims to design and implement an automatic feeder based on the Wokwi platform connected to the Blynk application. This system enables more efficient feeding management with remote control capabilities and real-time notifications [14], [15]. By automating feeding using an IoT-based system, this research is expected to address the classic problems of feed management, improve fish growth, and reduce feed waste, while supporting more sustainable aquaculture practices.

2. METHOD RESEARCH

This research employs an experimental approach to develop a smart feeding system aimed at automating the feeding process for fish in a more efficient manner. The methodology consists of key stages, including hardware and software component selection, system design, testing, and evaluation.

2.1 Hardware Components

The hardware used in this study consists of several key components, each playing a critical role in automating the fish feeding process:

a) **Arduino Uno**
Serves as the main microcontroller, managing all system operations related to feeding automation.

b) **Servo Motor**
Responsible for controlling the feeder mechanism, dispensing fish feed in precise amounts as programmed.

c) **Ultrasonic Sensor**
Continuously monitors water levels and feed availability, ensuring the system functions properly and sends alerts if feed is running low.

d) **WiFi Module (ESP8266)**
This module allows the system to connect to the internet, enabling remote access and control through the Blynk platform.

Each component is carefully selected to ensure efficient and reliable system performance, with the goal of reducing manual intervention in the feeding process.

2.2 Software and Platform

The software tools and platforms used in this research include:

a) **Wokwi Simulator**
Before implementing the system with physical hardware, an online simulator (Wokwi) was used for initial development. The simulator allows for virtual testing of the system's components, reducing the risk of hardware damage during early-stage testing.

b) **Blynk**
The Blynk platform was chosen for its ability to provide remote control and monitoring via a smartphone application. It offers real-time feedback, allowing users to control feeding schedules and receive notifications when the system detects any issues.

The combination of these tools supports the efficient development, testing, and implementation of the automated feeding system.

2.3 Research Implementation Steps

The implementation of this research involved several key steps to ensure a successful design, development, and testing of the system:

a) **System Design**
The system design began with defining the operational workflow of each component. The Arduino Uno was programmed to control the servo motor based on input received from the ultrasonic sensor. This sensor detects when feed levels are low, and the Arduino triggers the motor to release feed at scheduled intervals. The WiFi module (ESP8266) establishes a connection to the internet, integrating the system with the Blynk platform for remote monitoring.

b) **Integration with Blynk**
To allow users to manage the feeder remotely, the system was integrated with the Blynk IoT platform. Through the Blynk mobile app, users can set feeding schedules, monitor system performance, and receive real-time alerts if the system encounters any issues, such as low feed levels or system malfunctions.

c) **Testing and Evaluation**
After system integration, the smart feeder was thoroughly tested to ensure it operated according to the specified requirements. Testing included:

1) **Functional Testing**: Verifying that the feeder dispenses the correct amount of feed at predetermined intervals.
2) **Remote Control Testing**: Ensuring the Blynk app can accurately control the feeder remotely.
3) **Alert Testing**: Testing the system's ability to send notifications to the user when the feed is running low or when there is a malfunction.

Block diagram of automatic fish feeding prototype design by integrating alerts on blynk apps. The prototype consists of input, microcontroller and output. The input is connected to NodeMCU as a data processor, where the inputs in this prototype are temperature sensors and RTC sensors. Then NodeMCU as a microcontroller sends data from the fire sensor to the buzzer and output. from the sensor to the servo motor and the Android Blynk application. Android application as an alarm when the fish is given feed, and the servo motor will be active open the food tube. The working process of the prototype is shown in Figure 1 as follows:

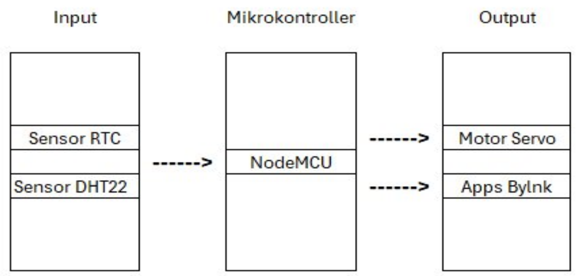

Fig. 1 Diagram Blocks

At this stage has a process flow that must be implemented to get the desired results. The flow of this research is shown in Figure 2.

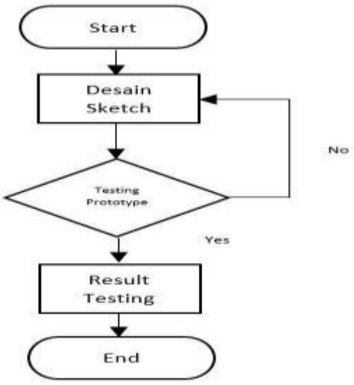

Fig. 2 The flow of this research

3. *RESULT AND DISCUSSION*

An automated fish feeding system using IoT technology is experiencing significant time changes and impacts on fish development. The system allows users to easily monitor and manage feed supplies. All components of the assembled system are placed next to the aquarium.

The analysis identifies the required hardware components: ESP32, DHT22 sensor, RTC DS1307, servo motor, and LCD display. Each component was selected based on its compatibility with the Wokwi simulation environment and Blynk platform.

Table 1. component testing table

Test Case	Expected Result	Result
Servo motor activation	Dispensing Feed	Success
DHT 22 Sensor readings	Accurate Temperature/Humidity	Success
RTC timing	Keeps Time Correctly	Success
LCD Display	Information displayed accordingly	Success
Blynk integration	Remote monitoring/control	Success

When the program is successfully activated, the LCD screen will display the words 'Online System'.

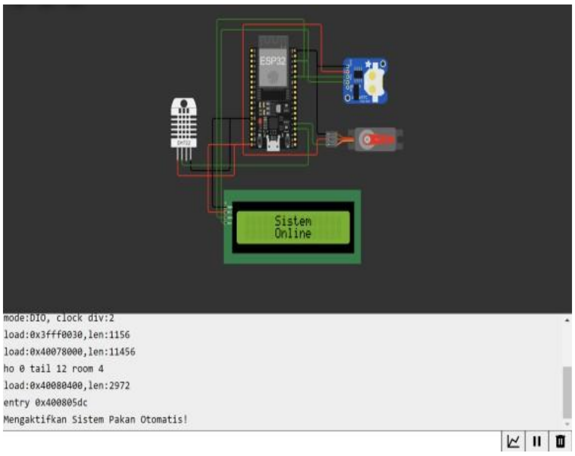

Fig. 3 the status will show 'Online' if successfully connected

Wokwi connects with Blynk, and the status will show 'Online' if successfully connected; conversely, the status will show 'Offline' if not connected. In addition, the Blynk display can be accessed through the website. To feed the fish, the user can press the button labeled 'Feed Status'; on the smartphone, the user can also press the button labeled 'Off' to stop the feeding.

Fig. 4 Status Blynk

The system was implemented in the Wokwi simulation environment. Tests were conducted to ensure that all components functioned properly simultaneously. The servos functioned to distribute the feed according to the schedule, while the DHT22 sensor monitored the environmental conditions with high accuracy. This project proved that using Wokwi is effective for simulating IoT projects, as well as Blynk for real-time remote control. The system successfully achieves the goal of feeding automation and enables remote monitoring.

4. CONCLUSION

The development of a Wokwi-based automated fish feeding system connected with Blynk successfully achieved its goal of automating the feeding process and enabling remote monitoring and control. This project proved the feasibility of using Wokwi in simulating IoT projects and Blynk for real-time remote management. The hardware components used, such as ESP32, DHT22 sensor, RTC DS1307, servo motor, and LCD display, have been successfully integrated and tested within the Wokwi simulation environment. Integration with Blynk offers a user-friendly interface for real-time control and monitoring, allowing users to set feeding schedules, receive notifications, and monitor environmental conditions remotely. This project shows how IoT technology can be used to create a cheap and effective fish feeding system, while opening up opportunities for remote automation in many other fields.

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